

NHD-C12832A1Z-FSR-FBW-3V3

COG (Chip-On-Glass) Liquid Crystal Display Module

| | |
|---------|---------------------------|
| NHD- | Newhaven Display |
| C12832- | 128 x 32 pixels |
| A1Z- | Model |
| F- | Transflective |
| SR- | Side Red LED Backlight |
| F- | FSTN (+) |
| B- | 6:00 view |
| W- | Wide Temp (-20°C ~ +70°C) |
| 3V3- | 3Vdd, 3V Backlight |

RoHS Compliant

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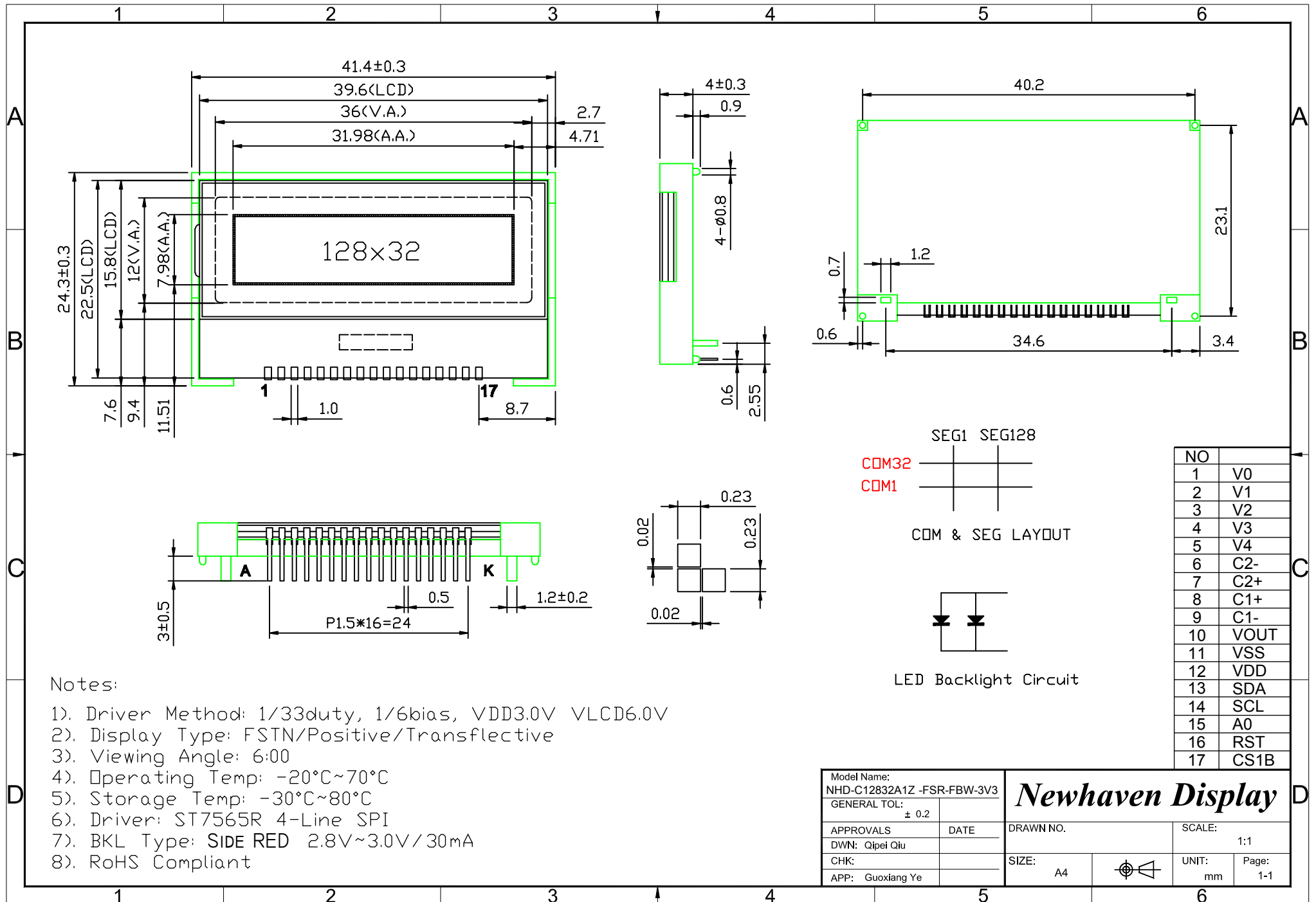
Document Revision History

| Revision | Date | Description | Changed by |
|----------|------------|---------------------|------------|
| 0 | 11/12/2008 | Initial Release | - |
| 1 | 9/27/2010 | User guide reformat | BE |
| | | | |

Functions and Features

- 128 x 32 pixels
- 4-line SPI MPU interfaces
- Built-in ST7565R controller
- +3.0V power supply
- 1/33 duty cycle; 1/6 bias
- RoHS Compliant

Mechanical Drawing



Notes:

- 1). Driver Method: 1/33duty, 1/6bias, VDD3.0V VLCD6.0V
- 2). Display Type: FSTN/Positive/Transflective
- 3). Viewing Angle: 6:00
- 4). Operating Temp: -20°C~70°C
- 5). Storage Temp: -30°C~80°C
- 6). Driver: ST7565R 4-Line SPI
- 7). BKL Type: SIDE RED 2.8V~3.0V/30mA
- 8). RoHS Compliant

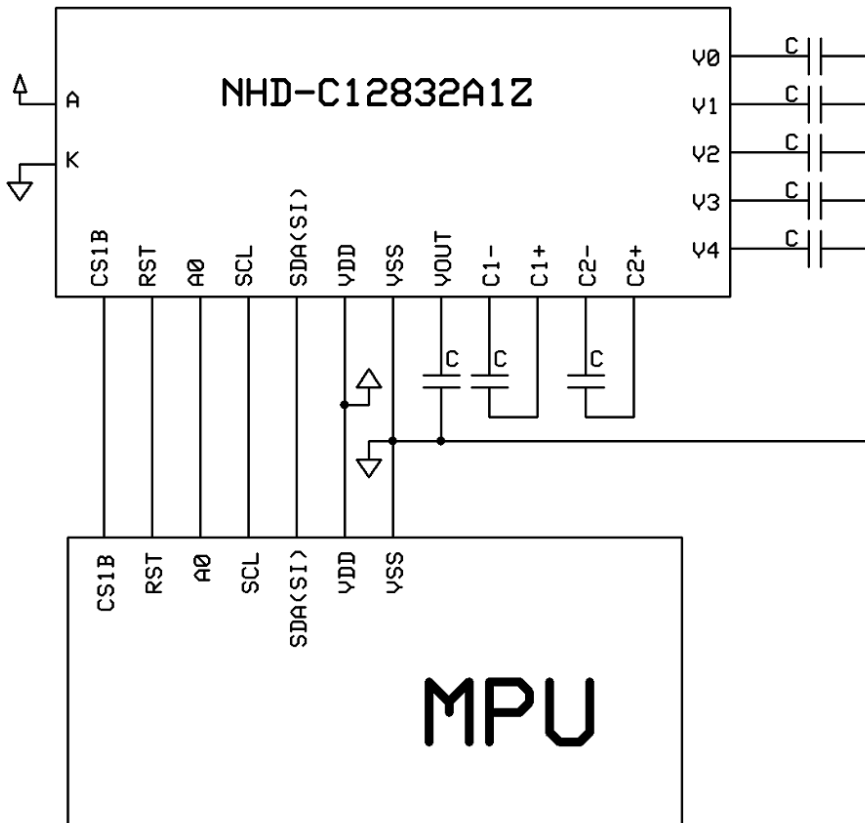
| | | | |
|---|------|-------------------------|---------------|
| Model Name: NHD-C12832A1Z -FSR-FBW-3V3 | | Newhaven Display | |
| GENERAL TOL: ± 0.2 | | | |
| APPROVALS | DATE | DRAWN NO. | SCALE: 1:1 |
| DWN: Qipei Qiu | | SIZE: A4 | UNIT: mm |
| CHK: | | APP: Guoxiang Ye | Page: 1-1 |

Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description |
|---------|---------|---------------------|--|
| 1 | V0 | Power Supply | 0.47uF-2.2uF Cap to Vss |
| 2 | V1 | Power Supply | 0.47uF -2.2uF Cap to Vss |
| 3 | V2 | Power Supply | 0.47uF -2.2uF Cap to Vss |
| 4 | V3 | Power Supply | 0.47uF -2.2uF Cap to Vss |
| 5 | V4 | Power Supply | 0.47uF 2.2uF Cap to Vss |
| 6 | C2- | Power Supply | Connect to 1uF Cap to C2+ (pin 7) |
| 7 | C2+ | Power Supply | Connect to 1uF Cap to C2- (pin 6) |
| 8 | C1+ | Power Supply | Connect to 1uF Cap to C1- (pin 9) |
| 9 | C1- | Power Supply | Connect to 1uF Cap to C1+ (pin 8) |
| 10 | VOUT | Power Supply | Connect to 1uF cap to Vss (pin 11) |
| 11 | Vss | Power Supply | GND |
| 12 | VDD | Power Supply | Power supply for LCD and logic (+3V) |
| 13 | SDA(SI) | MPU | Serial data |
| 14 | SCL | MPU | Serial clock |
| 15 | A0 | MPU | Select registers. 0: instruction, 1: data register |
| 16 | RST | MPU | External reset PIN. Must be fixed to VDD low active. |
| 17 | CS1B | MPU | Chip select in serial interface low active |
| A | LED+ | Power Supply | Power supply for LED Backlight (+3V) |
| K | LED- | Power Supply | Ground for Backlight |

Recommended LCD connector: 1.5mm pitch pins, solder directly into PCB

Backlight connector: 1.2mm Wide pins, solder directly into PCB **Mates with:** ---



Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------------|--------|-------------------|------|------|------|------|
| Operating Temperature Range | Top | Absolute Max | -20 | - | +70 | °C |
| Storage Temperature Range | Tst | Absolute Max | -30 | - | +80 | °C |
| Supply Voltage | VDD | | 2.7 | 3.0 | 3.3 | V |
| Supply Current | IDD | Ta=25°C, VDD=3.0V | - | 0.25 | 0.45 | mA |
| Supply for LCD (contrast) | VDD-V0 | Ta=25°C | - | 6.0 | - | V |
| "H" Level input | Vih | | 2.2 | - | VDD | V |
| "L" Level input | Vil | | 0 | - | 0.6 | V |
| "H" Level output | Voh | | 2.4 | - | - | V |
| "L" Level output | Vol | | - | - | 0.4 | V |
| | | | | | | |
| Backlight supply voltage | VLED | | - | 3.0 | - | V |
| Backlight supply current | ILED | VLED=3.0V | 20 | 30 | 45 | mA |

Optical Characteristics

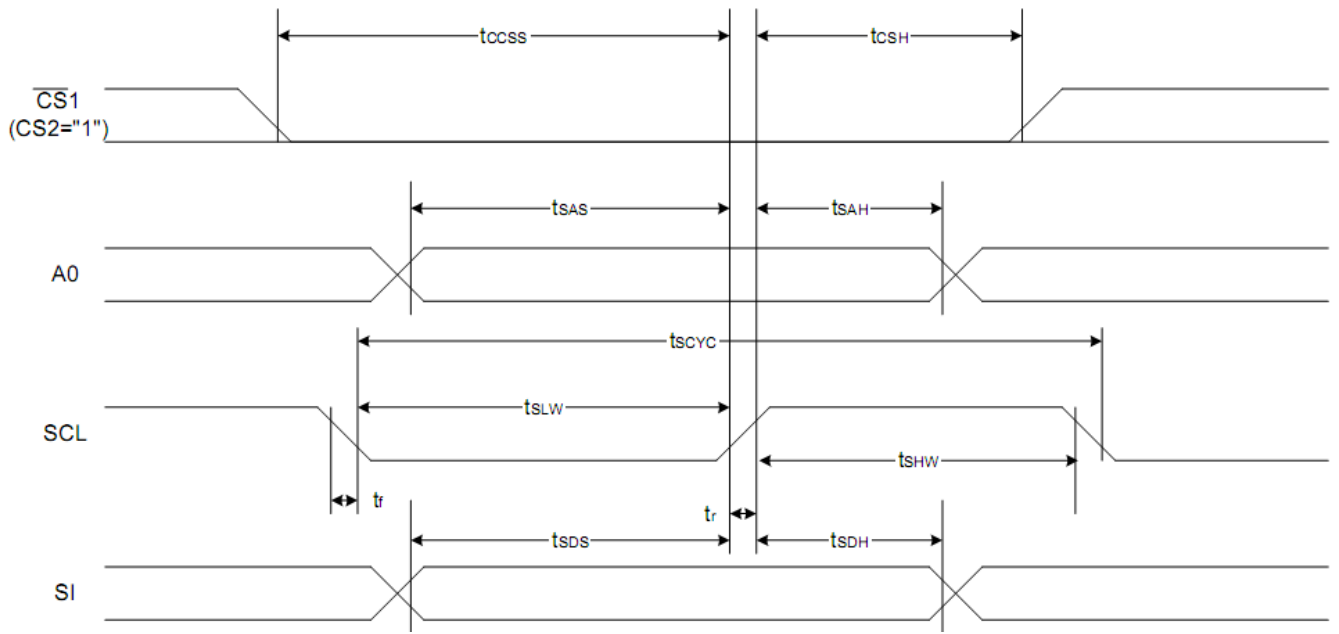
| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|----------|-----------|------|------|------|------|
| Viewing Angle - Vertical | θ | Cr≥2 | -60 | - | +35 | ° |
| Viewing Angle - Horizontal | Φ | | -40 | - | +40 | ° |
| Contrast Ratio | CR | | - | 6 | - | - |
| Response Time (rise) | Tr | - | - | 150 | 250 | ms |
| Response Time (fall) | Tf | - | - | 150 | 250 | ms |

Controller Information

Built-in ST7565R. Download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

Timing Characteristics

The 4-line SPI Interface



| Item | Signal | Symbol | Condition | Rating | | Units |
|-------------------------|--------|------------|-----------|--------|------|-------|
| | | | | Min. | Max. | |
| 4-line SPI Clock Period | SCL | T_{scyc} | | 50 | — | ns |
| SCL "H" pulse width | | T_{shw} | | 25 | — | |
| SCL "L" pulse width | | T_{SLW} | | 25 | — | |
| Address setup time | A0 | T_{sAS} | | 20 | — | |
| Address hold time | | T_{sah} | | 10 | — | |
| Data setup time | SI | T_{sds} | | 20 | — | |
| Data hold time | | T_{SDH} | | 10 | — | |
| CS-SCL time | CS | T_{css} | | 20 | — | |
| CS-SCL time | | T_{csh} | | 40 | — | |

*1 The input signal rise and fall time (t_r , t_f) are specified at 15 ns or less.

*2 All timing is specified using 20% and 80% of V_{DD} as the standard.

Reset Timing

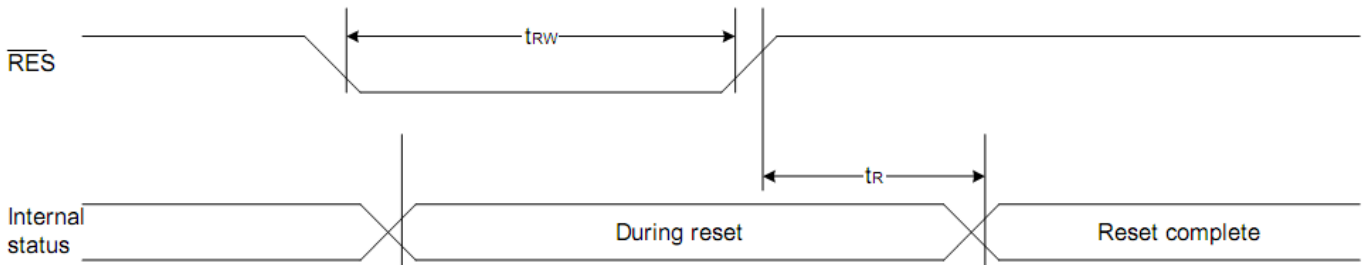


Table of Commands

| Command | Command Code | | | | | | | | | Function | | | | |
|---|--------------|-----|-----|------------|----|-------------------------|----|----------------------------------|----------------|----------|----|---|--|---|
| | A0 | /RD | /WR | D7 | D6 | D5 | D4 | D3 | D2 | | D1 | D0 | | |
| (1) Display ON/OFF | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | LCD display ON/OFF 0: OFF, 1: ON | |
| (2) Display start line set | 0 | 1 | 0 | 0 | 1 | Display start address | | | | | 0 | Sets the display RAM display start line address | | |
| (3) Page address set | 0 | 1 | 0 | 1 | 0 | 1 | 1 | Page address | | | | 0 | Sets the display RAM page address | |
| (4) Column address set upper bit | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Most significant column address | | | | 0 | Sets the most significant 4 bits of the display RAM column address. | |
| Column address set lower bit | | | | 0 | 0 | 0 | 0 | Least significant column address | | | | | Sets the least significant 4 bits of the display RAM column address. | |
| (5) Status read | 0 | 0 | 1 | Status | | | | 0 | 0 | 0 | 0 | 0 | Reads the status data | |
| (6) Display data write | 1 | 1 | 0 | Write data | | | | | | | 0 | Writes to the display RAM | | |
| (7) Display data read | 1 | 0 | 1 | Read data | | | | | | | 0 | Reads from the display RAM | | |
| (8) ADC select | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Sets the display RAM address SEG output correspondence 0: normal, 1: reverse |
| (9) Display normal/reverse | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | Sets the LCD display normal/ reverse 0: normal, 1: reverse |
| (10) Display all points ON/OFF | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Display all points 0: normal display 1: all points ON |
| (11) LCD bias set | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565R) |
| (12) Read-modify-write | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Column address increment At write: +1 At read: 0 |
| (13) End | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | Clear read/modify/write |
| (14) Reset | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | Internal reset |
| (15) Common output mode select | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | * | * | * | * | Select COM output scan direction 0: normal direction 1: reverse direction |
| (16) Power control set | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | Operating mode | | | 0 | Select internal power supply operating mode | |
| (17) V ₀ voltage regulator internal resistor ratio set | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | Resistor ratio | | | 0 | Select internal resistor ratio(Rb/Ra) mode | |
| (18) Electronic volume mode set | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Set the V ₀ output voltage electronic volume register |
| Electronic volume register set | | | | 0 | 0 | Electronic volume value | | | | | 0 | | | |
| (19) Sleep mode set | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0: Sleep mode, 1: Normal mode |
| (20) Booster ratio set | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x |
| (21) NOP | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | Command for non-operation |
| (22) Test | 0 | 1 | 0 | 1 | 1 | 1 | 1 | * | * | * | * | * | * | Command for IC test. Do not use this command |

Example Initialization Program

```
void data_out(unsigned char i) //Data Output Serial Interface
{
    unsigned int n;
    CS = 0;
    A0 = 1;
    for(n=0; n<8; n++){
        i <<=1;
        SCL = 0;
        P1 = i;
        delay(2);
        SCL = 1;
    }
    CS = 1;
}

void comm_out(unsigned char j) //Command Output Serial Interface
{
    unsigned int n;
    CS = 0;
    A0 = 0;
    for(n=0; n<8; n++){
        j <<=1;
        SCL = 0;
        P1 = j;
        delay(2);
        SCL = 1;
    }
    CS = 1;
}

/*****
*      Initialization For controller      *
*****/
void init_LCD()
{
    comm_out(0xA0);
    comm_out(0xAE);
    comm_out(0xC0);
    comm_out(0xA2);
    comm_out(0x2F);
    comm_out(0x26);
    comm_out(0x81);
    comm_out(0x2F);
}
/*****/
```


Quality Information

| Test Item | Content of Test | Test Condition | Note |
|---------------------------------------|---|---|------|
| High Temperature storage | Endurance test applying the high storage temperature for a long time. | +80°C , 48hrs | 2 |
| Low Temperature storage | Endurance test applying the low storage temperature for a long time. | -30°C , 48hrs | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time. | +70°C 48hrs | 2 |
| Low Temperature Operation | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time. | -20°C , 48hrs | 1,2 |
| High Temperature / Humidity Operation | Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time. | +40°C , 90% RH , 48hrs | 1,2 |
| Thermal Shock resistance | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress. | -0°C,30min -> 25°C,5min -> 50°C,30min = 1 cycle 10 cycles | |
| Vibration test | Endurance test applying vibration to simulate transportation and use. | 10-55Hz , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes | 3 |
| Static electricity test | Endurance test applying electric static discharge. | VS=800V, RS=1.5kΩ, CS=100pF One time | |

Note 1: No condensation to be observed.

Note 2: Conducted after 4 hours of storage at 25°C, 0%RH.

Note 3: Test performed on product itself, not inside a container.

Precautions for using LCDs/LCMs

See Precautions at www.newhavendisplay.com/specs/precautions.pdf

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms



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